APPENDIX E
Bird Species and Associated Habitats in the Lake Istokpoga Area

INTRODUCTION

Many species of birds depend on different habitats for different purposes, such as feeding or nesting. For example, wading birds typically forage for food in marshes or in shallow open-water areas, but roost and nest in trees. A habitat disturbance in nesting, roosting and foraging areas may impact bird population distribution and reproductive success.

Studies that directly relate severity of low water events to avian community impacts or reduced utilization of lake resources are lacking for most species. These types of studies are difficult to conduct as many birds are capable of searching for resources across a sizable geographical area. In addition, short-term and long-term affects on avian populations may be quite different. For example, extended periods of low lake levels may have short-term benefits to many species of wading birds that feed on mud flats and exploit trapped prey in shallow pools (Kushlan 1976, 1986, 1989). However, frequently recurring or extreme low water events that cause a decline in prey species reproduction, growth or habitat may also reduce prey numbers or size distributions, which could impact bird species that depend on only a limited prey diet (e.g. the Everglades Snail Kite, which feeds almost exclusively on apple snails). A reduction of wetland area could also impact bird species that uses these habitats for nesting and roosting.

The purpose of this analysis is to identify bird species and their associated habitats within the Lake Istokpoga area. Extreme low water levels that degrade Lake Istokpoga habitats may potentially impact the bird species that utilize those habitats. This analysis proceeded according to the following steps: 1) the bird species found within the Lake Istokpoga area were identified; 2) the respective habitats used by those species for feeding, roosting and nesting were compiled and described; and 3) the habitat types are associated with Lake Istokpoga and affected by lake levels were identified. A potential impact to habitats important to avian species resulting from low water conditions was a factor considered in development of the proposed technical criteria for the Lake Istokpoga Minimum Flow and Level.

BIRD SPECIES IN THE LAKE ISTOKPOGA AREA

A comprehensive list of bird species that are believed to be breeding in Highlands County was obtained from the Florida Fish and Wildlife Conservation Commission (Kale et. al. 1992, Rodgers *et al*. 1996, Pranty 2002, FWC 2003) (**Table E-1**). This list does not include migratory species that pass through the Lake Istokpoga area while traveling between winter and summer ranges. If these transient species were included, the total count would likely increase substantially.

Table E-1. Breeding Bird Species found in Highlands County (Source: Kale 1992, Rogers *et al*. 1996, Pranty 2002, FWC 2003).

Species (Common Name-Scientific Name)	Breeding Status
American Crow (*Corvus brachyrhynchos*)	Confirmed Breeding
American Kestrel (*Falco sparverius*)	Probable Breeding
Bachman's Sparrow (*Aimophila aestivalis*)	Possible Breeding
Bald Eagle (*Haliaeetus leucocephalus*)	Confirmed Breeding
Barred Owl (*Strix varia*)	Confirmed Breeding
Black-Necked Stilt (*Himantopus mexicanus*)	Confirmed Breeding
Black Vulture (*Coragyps atratus*)	Confirmed Breeding
Blue-Gray Gnatcatcher (*Polioptila caerulea*)	Probable Breeding
Blue Grosbeak (*Guiraca caerulea*)	Probable Breeding
Blue Jay (*Cyanocitta cristata*)	Confirmed Breeding
Boat-Tailed Grackle (*Quiscalus major*)	Confirmed Breeding
Brown Thrasher (*Toxostoma rufum*)	Confirmed Breeding
Carolina Wren (*Thryothorus ludovicianus*)	Confirmed Breeding
Cattle Egret (*Bubulcus ibis*)	Confirmed Breeding
Chimney Swift (*Chaetura pelagica*)	Confirmed Breeding
Chuck-Will's-Widow (*Caprimulgus carolinensis*)	Confirmed Breeding
Common Grackle (*Quiscalus quiscula*)	Confirmed Breeding
Common Ground Dove (*Columbina passerina*)	Confirmed Breeding
Common Moorhen (*Gallinula chloropus*)	Confirmed Breeding
Common Nighthawk (*Chordeiles minor*)	Probable Breeding
Common Yellowthroat (*Geothlypis trichas*)	Confirmed Breeding
Cooper's Hawk (*Accipiter cooperii*)	Probable Breeding
Downy Woodpecker (*Picoides pubescens*)	Confirmed Breeding
Eastern Meadowlark (*Sturnella magna*)	Confirmed Breeding
Eastern Screech-Owl (*Otus asio*)	Confirmed Breeding
Eastern Towhee (*Pipilo erythrophthalmus*)	Confirmed Breeding
Eurasian Collared-Dove (*Streptopelia decaocto*)	Confirmed Breeding
European Starling (*Sturnus vulgaris*)	Confirmed Breeding
Everglades Snail Kite (*Rostrahamus sociabilis*)	Possible Breeding
Fish Crow (*Corvus ossifragus*)	Confirmed Breeding
Florida Scrub Jay (*Aphelocoma coerulescens*)	Confirmed Breeding
Fulvous Whistling-Duck (*Dendrocygna bicolor*)	Confirmed Breeding
Great Blue Heron (*Ardea herodias*)	Confirmed Breeding
Great Crested Flycatcher (*Myiarchus crinitus*)	Confirmed Breeding
Great Egret (*Ardea alba*)	Confirmed Breeding
Green Heron (*Butorides virescens*)	Confirmed Breeding
Great Horned Owl (*Bubo virginianus*)	Confirmed Breeding
Hairy Woodpecker (*Picoides villosus*)	Possible Breeding

Table E-1. Breeding Bird Species found in Highlands County (Continued).

Species (Common Name-Scientific Name)	Breeding Status
Killdeer (*Charadrius vociferous*)	Confirmed Breeding
Limpkin (*Aramus guarauna*)	Confirmed Breeding
Loggerhead Shrike (*Lanius ludovicianus*)	Confirmed Breeding
Mallard (*Anas platyrhynchos*)	Confirmed Breeding
Mottled Duck (*Anas fulvigula*)	Confirmed Breeding
Mourning Dove (*Zenaida macroura*)	Confirmed Breeding
Muscovy Duck (*Cairina moschata*)	Confirmed Breeding
Northern Bobwhite (*Colinus virginianus*)	Confirmed Breeding
Northern Cardinal (*Cardinalis cardinalis*)	Confirmed Breeding
Northern Flicker (*Colaptes auratus*)	Confirmed Breeding
Northern Harrier (*Circus cyaneus*)	Probable Breeding
Northern Mockingbird (*Mimus polyglottos*)	Confirmed Breeding
Northern Parula (*Parula americana*)	Possible Breeding
Osprey (*Pandion haliaetus*)	Confirmed Breeding
Pied-Billed Grebe (*Podilymbus podiceps*)	Probable Breeding
Pileated Woodpecker (*Dryocopus pileatus*)	Confirmed Breeding
Pine Warbler (*Dendroica pinus*)	Probable Breeding
Purple Gallinule (*Porphyrula martinica*)	Confirmed Breeding
Purple Martin (*Progne subis*)	Confirmed Breeding
Red-Bellied Woodpecker (*Melanerpes carolinus*)	Confirmed Breeding
Red-Eyed Vireo (*Vireo olivaceus*)	Possible Breeding
Red-Headed Woodpecker (*Melanerpes erythrocephalus*)	Confirmed Breeding
Red-Shouldered Hawk (*Buteo lineatus*)	Confirmed Breeding
Red-Tailed Hawk (*Buteo jamaicensis*)	Probable Breeding
Red-Winged Blackbird (*Agelaius phoeniceus*)	Confirmed Breeding
Rock Dove (*Columba livia*)	Probable Breeding
Ruby-Throated Hummingbird (*Archilochus colubris*)	Probable Breeding
Sandhill Crane (*Grus Canadensis*)	Confirmed Breeding
Short-Tailed Hawk (*Buteo brachyurus*)	Probable Breeding
Swallow-Tailed Kite (*Elanoides forfifcatus*)	Possible Breeding
Tricolored Heron (*Egretta tricolor*)	Confirmed Breeding
Tufted Titmouse (*Parus bicolor*)	Confirmed Breeding
Yellow-Billed Cuckoo (*Coccyzus americanus*)	Possible Breeding
Yellow-Throated Warbler (*Dendroica dominica*)	Possible Breeding
White-Eyed Vireo (*Vireo griseus*)	Confirmed Breeding
White-Winged Dove (*Zenaida asiatica*)	Confirmed Breeding
Wood Duck (*Aix sponsa*)	Confirmed Breeding

HABITAT REQUIREMENTS OF BIRDS IN THE LAKE ISTOKPOGA AREA

Bird reference guides and other resources were consulted to determine the general habitats used by the species listed in **Table E-1**. A summary of this information is presented in **Tables E-2** and **E-3**, which describes the preferred food, feeding habitats, nesting season and nesting habitats. Lake Istokpoga contains three primary types of habitats that are important for bird species: 1) aquatic; 2) littoral zone marsh; and 3) swamp. **Figure E-1** shows the distribution of these habitat types around Lake Istokpoga and the aerial extent of each are shown in **Table E-4**.

Aquatic habitats are open-water areas that may contain submerged vegetation. A wide variety of fish are found in the water column and numerous species of invertebrates and other small animals live within the vegetation beds. Examples of some bird species that use this habitat include the bald eagle, black-necked stilt, common moorhen, osprey, egrets, herons and some ducks. Low water events that cause drying of aquatic vegetation beds or negatively impact native aquatic vegetation can potentially affect the fish and invertebrate populations that are important food sources for some bird species. Active management of aquatic habitats and control of weedy and invasive species is necessary to maintain healthy aquatic communities in Lake Istokpoga.

Littoral zone marshes are found on the broad flats that surround the lake. Marsh vegetation provides shelter and food for a variety of organism that are important prey for some bird species. In addition, tall wetland plants provide nesting sites and cover for a number of birds. Some birds that utilize the littoral marsh for feeding or nesting include a variety of wading birds, ducks and gallinules. Although occasional drawdowns of surface water in marsh habitats is a natural occurrence, extreme or prolonged low water events that cause a loss of marsh vegetation or promote dense growths of weedy or invasive vegetation (e.g. torpedo grass) can reduce habitat quality. Vegetation management programs have focused on maintaining and enhancing the lake's marsh habitats.

Forested wetlands, or swamps, are found mostly along the southern shoreline (**Figure E-1**). These forests are located behind the littoral zone and are important roosting and nesting sites for wading birds and many raptors (McNair *et al*. 2001, Stewart 2001). Examples of bird species that utilize this habitat include the American kestrel, bald eagle, barred owl, osprey, hawks, herons and kites. Generally, this habitat type is less sensitive to low water events than aquatic beds and marsh, and most swamp tree species can tolerate prolonged periods of low water levels. However, there are concerns that sufficient flooding of these habitats does not occur and it has been noted that the bald cypress and mixed hardwood forests along Lake Istokpoga are not successfully reproducing. Although this condition may not be a direct result of prolonged low water levels, the hydropattern characteristics that support reproduction of this important habitat type have implications for the local avian populations.

Table E-2. Food Resource Habitats for Breeding Bird Species in the Lake Istokpoga Area.

Species	Preferred Food[1]	Primary Feeding Habitat[1]
American Kestrel	Large insects, small vertebrates	Littoral, swamp
Bald Eagle	Fish, small birds, small animals, carrion	Aquatic[2], littoral, swamp
Barred Owl	Various small vertebrates and invertebrates	Littoral, swamp
Black-Necked Stilt	Fish, aquatic organisms	Aquatic, littoral
Common Moorhen	Aquatic vegetation, seeds, fruit, insects, small invertebrates, small frogs	Aquatic, littoral
Cooper's Hawk	Small birds	(Littoral, swamp) [3]
Fulvous Whistling-Duck	Aquatic vegetation	Aquatic, littoral
Great Blue Heron	Fish, insects, crustaceans, amphibians, snakes, young birds, rodents	Aquatic, littoral, swamp
Great Egret	Fish, aquatic organisms	Aquatic, littoral, swamp
Green Heron	Insects, spiders, snails, crustaceans, frogs, fish	Aquatic, littoral, swamp
Limpkin	Mollusks, especially apple snails	Littoral
Mallard	Aquatic vegetation	Aquatic, littoral
Mottled Duck	Insects, snails, mollusks, crayfish, small fish, seeds, stems, roots	Aquatic, littoral
Northern Harrier	Rodents, small birds, snakes, frogs, large insects	Aquatic, littoral, swamp
Osprey	Primarily fish; also some crustaceans, frogs, turtles, birds, rodents	Aquatic, swamp
Pied-Billed Grebe	Diving feeder; insects, crayfish, fish	Aquatic
Purple Gallinule	Aquatic vegetation, insects, small invertebrates, small frogs	Aquatic, littoral
Red-Shouldered Hawk	Sluggish animals (e.g. frogs, toads, snakes, rodents, nestlings)	Littoral, swamp
Red-Tailed Hawk	Small mammals	Littoral, swamp
Red-Winged Blackbird	Seeds, insects and other invertebrates	Littoral
Sandhill Crane	Insects, earthworms, small vertebrates and assorted vegetation	Littoral
Short-Tailed Hawk	Small birds	(Littoral, swamp) [2]
Everglades Snail Kite	Apple snails	Littoral
Swallow-Tailed Kite	Insects, anoles, frogs, snakes, nestling songbirds and small mammals	Littoral, swamp
Tricolored Heron	Small fish	Aquatic, littoral
Wood Duck	Vegetation, plant material, invertebrates	Aquatic, littoral

1. Source: National Geographic Society 1987, Ehrlich *et al*. 1988, Poole *et al*. 1992, Bird 1999.
2. Indicates habitats that have very long hydroperiods, such as aquatic beds and mud flats that may occasionally be exposed during drought conditions.
3. Indicates an indirect association.

Table E-3. Typical Nesting Habitats and Seasons for Breeding Bird Species in the Lake Istokpoga Area.

Species (Common Name)	Typical Nesting Season[1]	Primary Nesting Habitat[1]
American Kestrel	March through June	Cavity nests in swamp trees
Bald Eagle	September through May	High nest on swamp trees
Barred Owl	December through April	Cavity nests in swamp trees
Black-Necked Stilt	April through June	Littoral vegetation
Common Moorhen	March through September	Littoral vegetation
Cooper's Hawk	April through July	Swamp trees
Fulvous Whistling-Duck	March through August	Littoral vegetation
Great Blue Heron	Extended through much of the year	Swamp trees
Great Egret	Year-round	Swamp trees
Green Heron	March through July	Swamp trees or shrubs
Limpkin	February through June	Littoral vegetation
Mallard		Littoral vegetation
Mottled Duck	February through September	Littoral vegetation
Northern Harrier	February through September*	
Osprey	Year-round	High nest on swamp tree
Pied-Billed Grebe	Year-round	Littoral vegetation
Purple Gallinule	March through September	Littoral vegetation
Red-Shouldered Hawk	January through May	Swamp trees
Red-Tailed Hawk	January through June	Nest in mature tree-swamp
Pied-Billed Grebe	March through July	Littoral vegetation
Sandhill Crane	December through June	Often nests in wet areas-littoral
Short-Tailed Hawk	February through May	Swamp tree
Everglades Snail Kite	Year-round	Swamp or littoral vegetation
Swallow-Tailed Kite	April	Tall cypress tree-swamp
Tricolored Heron	February through August	Swamp trees or shrubs
Wood Duck	January through June	Cavity nests

1. Source: National Geographic Society 1987, Ehrlich *et al*. 1988, Poole *et al*. 1992, Bird 1999.

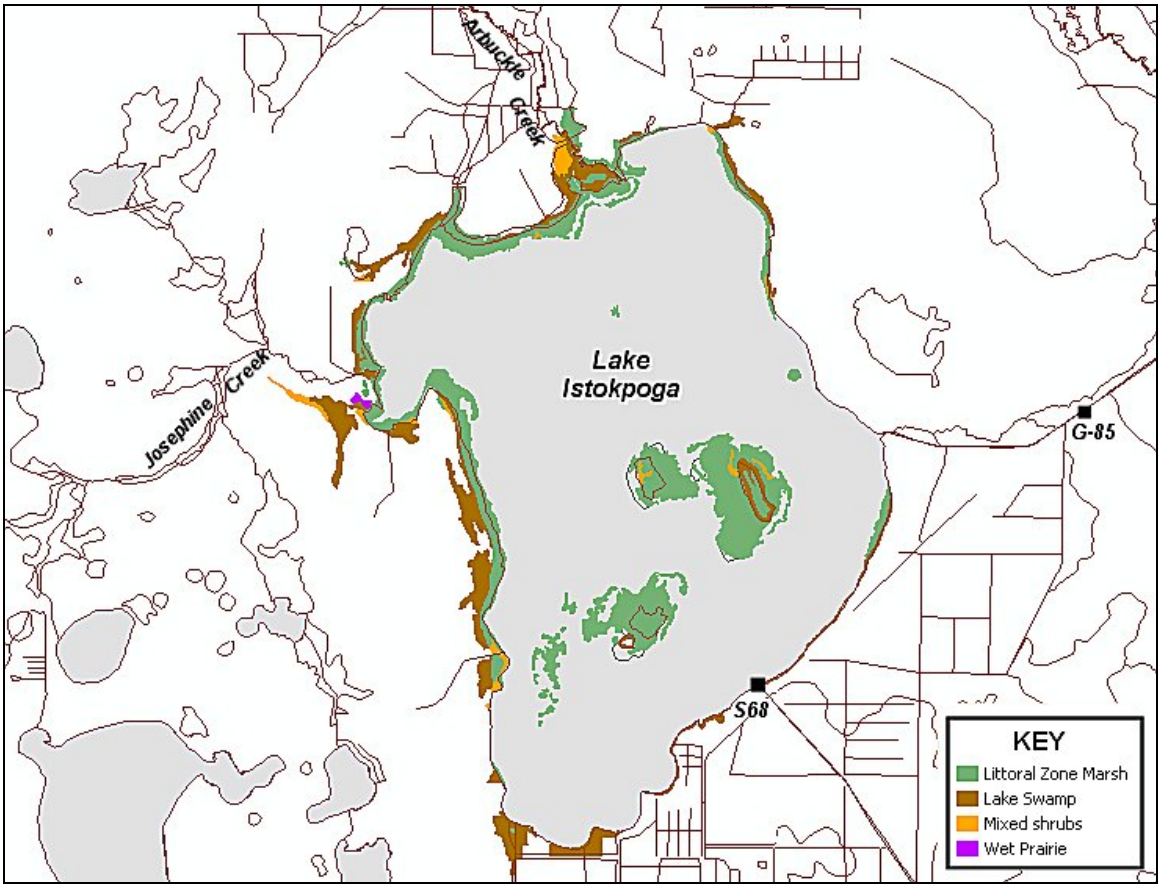

Figure E-1. Lake Istokpoga Wetlands (Source data: 1995 FLUCCS).

Table E-4. Aerial Extent of Lake Istokpoga Habitats Important to Bird Species (Source data: FDOT 1995).

Habitat Type	Area (acres)	Area (hectares)
Littoral Zone Marsh All vegetation non-forested wetlands including emergent marsh, sloughs and cattails.	3,480	1,411
Lake Swamp All forested wetlands including cypress, mixed and hardwood-dominated swamps.	1,700	686
Mixed Shrubs and Wet Prairie Seasonally inundated wetlands that are dominated by shrubby vegetation or grasses.	280	113
Aquatic/Open Water Open water habitat, including submerged aquatic vegetation beds and non-vegetated lake bottom.	Varies with lake stage	Varies with lake stage

LAKE HABITAT UTILIZATION BY BIRDS

During the life cycle of a bird, typically more than one habitat type is exploited; sometimes one habitat is used for feeding and another for nesting and rearing of chicks. A review of information in **Table E-3** indicates that most breeding bird species in the Lake Istokpoga area nest in a single habitat type; with swamp trees often being the preferred site (see **Tables E-5** and **E-6**). This specificity of nesting requirements is an important consideration in natural resource management and protection of existing resources. Hydrological conditions that lead to a reduction in swamp or marsh quality or extent could also reduce breeding success of some bird species. For example, ospreys nest in the swamp adjacent to the lake and feed from the lake's aquatic habitat (Stewart 2001). Of the 26 bird species identified in **Table E-2**, 21 utilize more than one habitat type.

Table E-5. Potential Habitat Use by Bird Species within Lake Istokpoga.

Habitat Use	Habitat Type		
	Aquatic	Marsh	Swamp
Used as a Feeding Habitat by Breeding Species (Number of Species)	15	24	13
Used as a Nesting Habitat by Breeding Species (Number of Species)	0	11	15
Used as a Feeding and Nesting Habitat by Breeding Species (Number of Species)	0	10	12

Table E-6. Summary of Habitat Specificity of Birds in the Lake Istokpoga Area.

Breeding Species	Number of Species	Percent of Species	Examples
Typically Use One Feeding Habitat Type*	5	19	Limpkin, Pied-Billed Grebe, Pied-Billed Grebe, Sandhill Crane, Everglades Snail Kite
Typically Use Two Feeding Habitat Types*	16	62	American Kestrel, Barred Owl, Black-Necked Stilt, Common Moorhen, Cooper's Hawk
Typically Use Three Feeding Habitat Types*	5	19	Bald Eagle, Great Blue Heron, Great Egret, Green Heron, Northern Harrier

*i.e. Lake Istokpoga habitats.

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